

ACR Appropriateness Criteria® Myelopathy: 2026 Update

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Abstract

Myelopathy, a clinical diagnosis of spinal cord dysfunction, necessitates appropriate imaging to differentiate between extrinsic and intrinsic pathologies. This document outlines evidence-based guidelines for imaging evaluation of acute, chronic, and vascular etiologies for myelopathy. These criteria provide an imaging framework to guide surgical or medical intervention.

The American College of Radiology Appropriateness Criteria are evidence-based guidelines for specific clinical conditions that are reviewed annually by a multidisciplinary expert panel. The guideline development and revision process support the systematic analysis of the medical literature from peer reviewed journals. Established methodology principles such as Grading of Recommendations Assessment, Development, and Evaluation or GRADE are adapted to evaluate the evidence. The RAND/UCLA Appropriateness Method User Manual provides the methodology to determine the appropriateness of imaging and treatment procedures for specific clinical scenarios. In those instances where peer reviewed literature is lacking or equivocal, experts may be the primary evidentiary source available to formulate a recommendation.

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The ACR Appropriateness Criteria documents are updated regularly. Please go to the ACR website at <https://www.acr.org/Clinical-Resources/Clinical-Tools-and-Reference/Appropriateness-Criteria> to confirm that you are accessing the most current content.

Disclaimer: The ACR Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the FDA have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

Key Words: Appropriateness Criteria, Appropriate Use Criteria, AUC, imaging, myelopathy, spinal cord, spine

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ACR Appropriateness Criteria® Myelopathy: 2026 Update. [Variants 1 to 3](#) and [Tables 1 and 2](#).

Variant 1. Adult. Acute onset myelopathy. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
MRI spine area of interest without and with IV contrast	Usually Appropriate	O
MRI spine area of interest without IV contrast	Usually Appropriate	O
CT myelography spine area of interest	May Be Appropriate	Varies
CT spine area of interest with IV contrast	May Be Appropriate	Varies
CT spine area of interest without IV contrast	May Be Appropriate	Varies
Arteriography spine area of interest	Usually Not Appropriate	Varies
Radiography spine area of interest	Usually Not Appropriate	Varies
MRA spine area of interest with IV contrast	Usually Not Appropriate	O
MRA spine area of interest without and with IV contrast	Usually Not Appropriate	O
MRA spine area of interest without IV contrast	Usually Not Appropriate	O
MRI spine area of interest with IV contrast	Usually Not Appropriate	O
CT spine area of interest without and with IV contrast	Usually Not Appropriate	Varies
CTA spine area of interest with IV contrast	Usually Not Appropriate	Varies

Variant 2. Adult. Chronic or progressive myelopathy. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
MRI spine area of interest without and with IV contrast	Usually Appropriate	O
MRI spine area of interest without IV contrast	Usually Appropriate	O
CT myelography spine area of interest	May Be Appropriate	Varies
CT spine area of interest with IV contrast	May Be Appropriate	Varies
CT spine area of interest without IV contrast	May Be Appropriate	Varies
Arteriography spine area of interest	Usually Not Appropriate	Varies
Radiography spine area of interest	Usually Not Appropriate	Varies
MRA spine area of interest with IV contrast	Usually Not Appropriate	O
MRA spine area of interest without and with IV contrast	Usually Not Appropriate	O
MRA spine area of interest without IV contrast	Usually Not Appropriate	O
MRI spine area of interest with IV contrast	Usually Not Appropriate	O
CT spine area of interest without and with IV contrast	Usually Not Appropriate	Varies
CTA spine area of interest with IV contrast	Usually Not Appropriate	Varies

Variant 3. Adult. Myelopathy with vascular etiology features on initial MRI. Next imaging study.

Procedure	Appropriateness Category	Relative Radiation Level
Arteriography spine area of interest	Usually Appropriate	Varies
MRA spine area of interest without and with IV contrast	Usually Appropriate	O
CTA spine area of interest with IV contrast	Usually Appropriate	Varies
MRA spine area of interest with IV contrast	May Be Appropriate	O
MRA spine area of interest without IV contrast	May Be Appropriate (Disagreement)	O
Radiography spine area of interest	Usually Not Appropriate	Varies
MRI spine area of interest with IV contrast	Usually Not Appropriate	O
MRI spine area of interest without and with IV contrast	Usually Not Appropriate	O
MRI spine area of interest without IV contrast	Usually Not Appropriate	O
CT myelography spine area of interest	Usually Not Appropriate	Varies
CT spine area of interest with IV contrast	Usually Not Appropriate	Varies
CT spine area of interest without and with IV contrast	Usually Not Appropriate	Varies
CT spine area of interest without IV contrast	Usually Not Appropriate	Varies

Table 1. Appropriateness category names and definitions

Appropriateness Category Name	Appropriateness Rating	Appropriateness Category Definition
Usually Appropriate	7, 8, or 9	The imaging procedure or treatment is indicated in the specified clinical scenarios at a favorable risk-benefit ratio for patients.
May Be Appropriate	4, 5, or 6	The imaging procedure or treatment may be indicated in the specified clinical scenarios as an alternative to imaging procedures or treatments with a more favorable risk-benefit ratio, or the risk-benefit ratio for patients is equivocal.
May Be Appropriate (Disagreement)	5	The individual ratings are too dispersed from the panel median. The different label provides transparency regarding the panel's recommendation. "May be appropriate" is the rating category and a rating of 5 is assigned.
Usually Not Appropriate	1, 2, or 3	The imaging procedure or treatment is unlikely to be indicated in the specified clinical scenarios, or the risk-benefit ratio for patients is likely to be unfavorable.

Table 2. Relative radiation level designations

RRL	Adult Effective Dose Estimate Range (mSv)	Pediatric Effective Dose Estimate Range (mSv)
O	0	0
⊛	<0.1	<0.03
⊛⊛	0.1-1	0.03-0.3
⊛⊛⊛	1-10	0.3-3
⊛⊛⊛⊛	10-30	3-10
⊛⊛⊛⊛⊛	30-100	10-30

Note: Relative radiation level (RRL) assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (eg, region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "varies."

SUMMARY OF LITERATURE REVIEW

Introduction/Background

Myelopathy refers to any pathologic process affecting the spinal cord. It is a clinical diagnosis based on signs and symptoms of spinal cord dysfunction [1]. Myelopathy can be due to primary intrinsic disorders of the spinal cord and include neoplastic, infectious, inflammatory, neurodegenerative, vascular, nutritional, and idiopathic disorders [2]. More commonly, however, myelopathy is due to secondary conditions, which result in extrinsic compression of the spinal cord. The most frequently encountered cause of extrinsic compression of the spinal cord in adults is degenerative disease of the cervical and thoracic spine [3].

Nondegenerative causes of compressive disease include trauma, bone metastases, lesions within the canal including intradural masses such as meningioma and nerve sheath tumor, infection/abscess, as well as benign cystic lesions, arachnoid cysts and webs, and ventral cord herniation [4-9].

Clinically, the diagnosis of myelopathy depends on the localization of the neurological finding to the spinal cord, rather than the brain or peripheral nervous system, and then to a particular segment of the spinal cord [10]. Some tract-specific processes can present in a clinically distinct manner, including toxic and metabolic processes affecting the dorsal columns, and infections that present with tract involvement such as COVID-19 myelopathy [1,11,12]. Acute myelopathy symptoms begin abruptly or have an onset of days to weeks, whereas chronic myelopathy has a time course of months to years. Imaging plays a crucial role in refining the differential diagnosis. Historically, radiological evaluation of myelopathic patients consisted of positive contrast myelography. Later, this evaluation was supplemented by CT and CT myelography. MRI is now the mainstay in the evaluation of myelopathy because of its superb contrast resolution of the spinal cord [13-16].

For the purposes of this discussion, myelopathy secondary to trauma is excluded; please see the ACR Appropriateness Criteria® topic on “[Acute Spinal Trauma](#)” [9] for further guidance.

Special Imaging Considerations

Although history and physical examination can help localize the myelopathic level, it may be beneficial to study the entire spine, even in the setting of a localized myelopathic level, as there may be additional lesions or sites of compression. More specialized techniques, such as diffusion tensor imaging, have continued to develop for both diagnosis and prediction of cervical cord diseases [17,18]. This technique has been used particularly for outcome prediction in the cervical spine in the setting of compressive myelopathy, though routine clinical use has been limited [19-21].

CT myelography is performed in conjunction with fluoroscopic myelography.

Initial Imaging Definition

Initial imaging is defined as imaging at the beginning of the care episode for the medical condition defined by the variant. More than one procedure can be considered usually appropriate in the initial imaging evaluation when:

- There are procedures that are equivalent alternatives (ie, only one procedure will be ordered to provide the clinical information to effectively manage the patient’s care)

OR

- There are complementary procedures (ie, more than one procedure is ordered as a set or simultaneously wherein each procedure provides unique clinical information to effectively manage the patient’s care).

DISCUSSION OF PROCEDURES BY VARIANT

Variant 1: Adult. Acute onset myelopathy. Initial imaging

The goal of imaging is to diagnose the type and extent of involvement of a myelopathy-inducing condition affecting the cord within the acute phase. Diagnostic imaging findings can potentially aid in early medical treatment of the underlying disease process, which can improve patient outcomes by reducing the duration of illness or severity of morbidity.

The body regions covered in this clinical scenario are the cervical, thoracic, and lumbar spine. These body regions may be evaluated separately or in combination as guided by physical examination findings, patient history, and other available information, including prior imaging.

Acute myelopathy can be subdivided into noninflammatory and inflammatory causes. Noninflammatory conditions include extrinsic compression of the spinal cord, vascular pathologies, and trauma. Inflammatory conditions include demyelinating diseases (eg, multiple sclerosis [MS]), systemic inflammatory diseases, and infection.

For the purposes of this discussion, myelopathy secondary to trauma is excluded; please see the ACR Appropriateness Criteria® topic on “[Acute Spinal Trauma](#)” [9] for further guidance. Additionally, myelopathy related to retropulsion from a fracture in the traumatic or nontraumatic setting of weakened bone (eg, pathologic and osteoporotic fractures) is also excluded; please see the ACR Appropriateness Criteria® topic on “[Management of Vertebral Compression Fractures](#)” [22] for further guidance.

All patients with acute onset myelopathy require evaluation for extrinsic compression of the spinal cord [3]. In

the acute setting, extrinsic compression of the spinal cord is most commonly caused by degenerative disease (spondylotic myelopathy) and is more prevalent in the cervical spine. Factors contributing to spondylotic myelopathy include spinal degenerative changes, disc herniations, malalignment, and spinal instability. These findings may be accentuated in the presence of congenitally short pedicles. Other causes of extrinsic compression of the spinal cord include pathology involving the epidural compartment (abscess or hematoma) [23]. In patients who have undergone spinal surgery, extrinsic compression of the spinal cord can develop throughout the postoperative course and may be secondary to seroma, pseudomeningocele, hematoma, and/or epidural abscess [24-26], as well as instrumentation including implants, such as stimulator electrode and fusion adjuncts, such as bone graft material and cement. Primary or metastatic tumors of the extradural and intradural extramedullary spaces encroaching upon the spinal canal can cause extrinsic compression of the spinal cord, resulting in not only acute but also progressive myelopathy (see Variant 2).

Please see the ACR Appropriateness Criteria® topic on “[Malignant or Aggressive Primary Musculoskeletal Tumor-Staging and Surveillance](#)” [27] for further details on extradural tumors.

Although infrequent, spinal cord ischemia can result in acute onset myelopathy and in adults is most commonly the result of atheromatous disease or as a complication of aortic surgery [3]. Other pathologies that may predispose patients to developing spinal cord ischemia include systemic hypotension, thoracoabdominal aneurysms or dissection, sickle cell disease, and spinal arteriovenous malformations [28,29]. Very rarely, patients may develop hematomyelia and subsequently acute myelopathy because of an intramedullary arteriovenous malformation or spinal artery aneurysm rupture [30,31]. Acute ischemic myelopathy can also develop in the setting of fibrocartilaginous embolic disease [32]. Depending on the level(s) of the spinal cord involved, patients will typically develop acute paraparesis or quadriparesis. Inflammatory conditions that can result in acute myelopathy include demyelinating diseases such as MS, neuromyelitis optica spectrum disorder (NMOSD), and acute disseminated encephalomyelitis (ADEM); systemic inflammatory conditions such as systemic lupus erythematosus, Sjögren syndrome, mixed connective tissue disorder, Behçet disease, and sarcoidosis; and infectious diseases [4].

MRI Spine Area of Interest Without and With IV Contrast. MRI spine is useful for evaluation of the spinal cord when investigating the etiology of acute myelopathy

[33]. MRI has superior soft tissue resolution and multiplanar capability, making it ideal for evaluation of the spinal canal and its contents, as well as the surrounding osseous and soft tissue structures [14-16,34-37].

Intramedullary cord signal changes on MRI in patients with spondylotic myelopathy represent prognostic factors for neurosurgical outcome [38-40]. Intravenous (IV) contrast is typically not required for the diagnosis of spondylotic myelopathy, but characteristic patterns of enhancement can be seen immediately at and below a level of stenosis [41,42].

In patients who have undergone spinal surgery, complications in the early postoperative setting (eg, hematoma) can result in extrinsic compression of the spinal cord and are best evaluated using MRI without and with IV contrast [24].

In cases in which spinal cord ischemia is suspected as the cause for acute myelopathy, MRI without and with IV contrast with diffusion-weighted imaging (DWI) is useful [28,29,43-45]. DWI can show signal alteration (ie, restricted diffusion) in the spinal cord earlier after patient symptom onset compared with T2-weighted images [46,47]. As such, DWI should be included anytime there is concern for spinal cord ischemia [28,48]. Contrast enhancement is typically not seen in the early phase of acute ischemia and, if present, may suggest an alternative inflammatory or infectious etiology [49].

When considering inflammatory or infectious etiologies of myelopathy, visualization of the osseous spinal column as well as the spinal cord is useful and best accomplished noninvasively by MRI.

Demyelinating diseases such as MS and NMOSD can present as acute myelopathy. MS is the classic demyelinating disease and is characterized by lesions affecting the spinal cord (and brain) and clinical defects disseminated in space and time [50]. Spinal cord involvement is seen in 80% to 90% of patients with MS, most commonly affecting the cervical cord. Patients with primary progressive MS tend to have more spinal cord involvement than patients with relapsing-remitting MS [51].

When myelopathy, due to MS is suspected, MRI detection of spinal cord lesion(s) fulfills part of the 2024 revised McDonald criteria [52]. NMOSD is a demyelinating condition characterized by optic neuritis and spinal cord lesions. Brain lesions are not as commonly encountered in NMOSD as in MS, and, when present, tend to predominate in regions around the third and fourth ventricles [53,54]. Additionally, MS demonstrates volumetric differences from NMOSD, with higher T2 lesion volume and decreased thalamic and gray matter volume [55,56]. ADEM is a demyelinating condition that typically manifests as encephalopathy. Spinal cord involvement is present in approximately 25% of cases of ADEM. MRI of the spine is generally

considered the reference standard for imaging of the spinal cord in cases of suspected demyelinating disease [57-59], in addition to excluding alternative etiologies. Contrast-enhanced imaging is recommended for initial diagnostic evaluation [60,61].

MRI Spine Area of Interest Without IV Contrast. MRI spine is useful for evaluation of the spinal cord when investigating the etiology of acute myelopathy [33]. The use of IV contrast is typically not required for the diagnosis of spondylotic myelopathy, but characteristic patterns of enhancement can be seen immediately at and below a level of stenosis [41,42].

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CT Myelography Spine Area of Interest. CT myelography spine may be useful in this setting to answer specific questions before surgical intervention. For example, it may be useful in the setting of metal implants (ie, spinal instrumentation, stimulator) if myelopathy is suspected and the region of interest is obscured due to MRI artifact [63,64]. In spondylotic myelopathy, conventional myelography can be used to diagnose severe canal stenosis [65,66]. However, MRI is best for evaluation of the marrow and the spinal canal/spinal cord [14-16].

CT Spine Area of Interest With IV Contrast. CT spine can depict osseous encroachment on the spinal canal from discs, osteophytes, and spondylolisthesis with better resolution than radiography. For inflammatory or infectious processes, CT can be beneficial to evaluate the osseous structures, and with the addition of IV contrast, CT can be helpful in demonstrating adjacent soft tissue involvement [67,68]; however, there is no relevant literature regarding improvement of myelopathy diagnosis with IV contrast.

Although CT demonstrates osseous integrity with excellent assessment of bone destruction, MRI provides better visualization of the marrow and the spinal cord [14-16]. CT of the spine is not useful in the initial evaluation of spinal cord ischemia [69].

CT Spine Area of Interest Without IV Contrast. CT spine can depict osseous encroachment on the spinal canal from discs, osteophytes, and spondylolisthesis with better resolution than radiography. For inflammatory or infectious processes, CT can be beneficial to evaluate the osseous structures [67,68]. Although CT demonstrates osseous integrity with excellent assessment of bone destruction, MRI provides better visualization of the marrow and the spinal cord [14-16]. CT of the spine is not useful in the initial evaluation of spinal cord ischemia [69].

Arteriography Spine Area of Interest. There is no relevant literature supporting the use of conventional arteriography spine in the initial imaging evaluation of acute onset myelopathy. It may be useful for follow-up evaluation of spinal cord ischemia and suspected spinal vascular malformations [69,70]. See Variant 3.

Radiography Spine Area of Interest. There is no relevant literature supporting the use of spine radiography as the initial imaging evaluation of acute onset myelopathy. Although radiographs may demonstrate bone destruction, CT provides better visualization of the osseous spine [14-16]. In spondylotic myelopathy, radiographs may depict osteophytic narrowing of the spinal canal, and dynamic imaging (flexion-extension radiographs) or comparing spinal alignment when weightbearing versus supine may help determine if spinal instability is present, which may be a cause of myelopathy, whereas conventional myelography can be used to diagnose severe canal stenosis [65]. However, MRI is best for evaluation of the marrow and the spinal canal/spinal cord [14-16]. Lateral radiographs can be obtained as an adjunct to cross-sectional imaging to help assess alignment parameters and dynamic instability [71].

MRA Spine Area of Interest With IV Contrast. There is no relevant literature supporting the use of MR angiography (MRA) spine in the initial imaging evaluation of acute onset myelopathy. In cases of spinal cord ischemia, MRA with IV contrast can be used to identify the artery of Adamkiewicz or vertebral artery dissection/occlusion and should be considered as a follow-up to MRI [51]. Although time-resolved MRA without and with IV contrast can be performed for suspected spinal vascular malformations in patients with hematomyelia, conventional angiography remains necessary for complete lesion characterization [70]. See Variant 3.

MRA Spine Area of Interest Without and With IV Contrast. There is no relevant literature supporting the use of MRA spine in the initial imaging evaluation of acute onset myelopathy. In cases of spinal cord ischemia, MRA with IV contrast can be used to identify the artery of Adamkiewicz or vertebral artery dissection/occlusion and should be considered as a follow-up to MRI [51]. Although time-resolved MRA without and with IV contrast can be performed for suspected spinal vascular malformations in patients with hematomyelia, conventional angiography remains necessary for complete lesion characterization [70]. See Variant 3.

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MRI Spine Area of Interest With IV Contrast. MRI spine with IV contrast is not typically performed independently as an initial study, as its interpretation is most informative when correlated with standard noncontrast sequences included in MRI spine without and with IV contrast.

CT Spine Area of Interest Without and With IV Contrast. CT spine can depict osseous encroachment on the spinal canal from discs, osteophytes, and spondylolisthesis with better resolution than radiography. For inflammatory or infectious processes, CT can be beneficial to evaluate the osseous structures, and with the addition of IV contrast, CT can be helpful in demonstrating adjacent soft tissue involvement [67,68]; however, there is no relevant literature regarding improvement of myelopathy diagnosis with IV contrast. Although CT demonstrates osseous integrity with excellent assessment of bone destruction, MRI provides better visualization of the marrow and the spinal cord [14-16]. CT of the spine is not useful in the initial evaluation of spinal cord ischemia [69].

CTA Spine Area of Interest With IV Contrast. There is no relevant literature supporting the use of CT angiography (CTA) spine in the initial imaging evaluation of acute onset myelopathy. In cases of spinal cord ischemia, CTA can be used to identify the artery of Adamkiewicz or vertebral artery dissection/occlusion and may be considered as a follow-up to MRI [51]. See Variant 3.

Variant 2: Adult. Chronic or progressive myelopathy. Initial imaging

The goal of imaging is to diagnose the type and extent of involvement of a myelopathy-inducing condition affecting the cord within the chronic phase. Diagnostic imaging findings can potentially aid in early medical treatment of the underlying disease process, which can improve patient outcomes by reducing the duration of illness or severity of morbidity.

The body regions covered in this clinical scenario are cervical, thoracic, and lumbar spine. These body regions may be evaluated separately or in combination as guided by physical examination findings, patient history, and other available information, including prior imaging.

As with acute myelopathy, all patients with chronic or progressive myelopathy require evaluation for extrinsic compression of the spinal cord [3]. In the chronic or progressive setting, extrinsic compression of the spinal cord is most commonly due to degenerative disease (spondylotic myelopathy) and is more prevalent in the cervical spine. Factors contributing to spondylotic myelopathy include spinal degenerative changes, disc herniations, epidural lipomatosis, and malalignment. These findings may be accentuated in the presence of congenitally short pedicles.

In patients who have undergone spinal surgery, extrinsic compression of the spinal cord can develop throughout the postoperative course and may be secondary to seroma, pseudomeningocele, hematoma, and/or epidural abscess [25]. Primary or metastatic tumors of the extradural and intradural extramedullary spaces encroaching upon the spinal canal can cause extrinsic compression of the spinal cord, resulting in progressive myelopathy as well as acute myelopathy (see Variant 1). Please see the ACR Appropriateness Criteria® topic on “[Malignant or Aggressive Primary Musculoskeletal Tumor-Staging and Surveillance](#)” [27] for further details on extradural tumors. Infrequently, other rare conditions such as Hirayama disease (cervical flexion myelopathy), dorsal arachnoid webs, and ventral cord herniation can result in progressive myelopathy [5,72-74].

Once extrinsic compression of the spinal cord has been excluded, chronic or progressive myelopathy can be subdivided into nonneoplastic and neoplastic causes. Non-neoplastic causes include demyelinating diseases such as MS, NMOSD, and ADEM; metabolic derangements such as vitamin B12 (cobalamin) deficiency, copper deficiency, and nitrous oxide inhalation; chronic infections including human T cell lymphotropic virus myelitis, tuberculosis, schistosomiasis, human immunodeficiency virus vacuolar myelopathy, and tertiary syphilis; prior radiation treatment;

autoimmune causes including paraneoplastic myelopathy; and vascular abnormalities such as spinal dural arteriovenous malformations/fistulas. Neoplastic causes include primary and metastatic tumors of the spinal cord.

MRI Spine Area of Interest Without and With IV Contrast. MRI spine is useful for evaluation of the spinal cord when investigating the etiology of chronic or progressive myelopathy [33]. MRI has superior soft tissue resolution and multiplanar capability, making it ideal for evaluation of the spinal canal and its contents as well as the surrounding osseous and soft tissue structures [14-16,34-37].

The imaging changes in the spinal cord due to myelomalacia and gliosis are best discerned by MRI [75,76]. Intramedullary cord signal changes on MRI in patients with spondylotic myelopathy represent prognostic factors for neurosurgical outcome [38,77-81]. The use of IV contrast is typically not required for the diagnosis of spondylotic myelopathy, but characteristic patterns of enhancement can be seen immediately at and below a level of stenosis [41,42].

In patients who have undergone spinal surgery, late complications (eg, adjacent level degenerative disease with spinal stenosis, recurrent disc herniation) can result in extrinsic compression of the spinal cord and are best evaluated using MRI without and with IV contrast [24].

Demyelinating diseases such as MS can present as subacute/chronic myelopathy. MS is the classic demyelinating disease and is characterized by lesions affecting the spinal cord (and brain) and clinical defects disseminated in space and time [50]. Spinal cord involvement is seen in 80% to 90% of patients with MS, most commonly affecting the cervical cord [62]. Patients with primary progressive MS tend to have more spinal cord involvement than patients with relapsing-remitting MS [51].

When myelopathy due to MS is suspected, MRI detection of spinal cord lesion(s) fulfills part of the 2024 revised McDonald criteria [52]. Other demyelinating processes such as NMOSD and ADEM can present as chronic myelopathy less commonly. In patients with chronic or progressive myelopathy, MRI of the spinal cord can identify spinal cord lesions suggestive of demyelinating disease in addition to excluding alternative etiologies. Contrast-enhanced imaging is recommended for initial diagnostic evaluation [60,61].

Metabolic causes of chronic or progressive myelopathy result in changes in the spinal cord known as subacute combined degeneration and are best evaluated with MRI [10,82,83]. Chronic infections can have a similar appearance [51].

Radiation-induced myelopathy is a rare, dose-dependent complication that anatomically localizes to a prior radiation port [84]. Autoimmune myelitis includes

paraneoplastic myelopathy [85,86]. MRI without and with IV contrast is useful to evaluate the spinal cord in these instances.

Vascular malformations can likewise present with chronic and slowly progressive myelopathy [87]. MRI without and with IV contrast is useful to demonstrate spinal cord edema caused by venous hypertension and enlarged veins along the dorsal surface of the spinal cord. There may be patchy intramedullary enhancement due to breakdown of the blood-cord barrier. In some cases, abnormal vasculature may be identified that may be useful to guide spinal arteriography and intervention [88-91].

Primary and metastatic tumors of the spinal cord very rarely cause myelopathy and are best evaluated on contrast-enhanced MRI of the spine [92-96]. The distinction of syrinx from tumor, location of small tumor nodules, extent of cyst, and distinction of nodule and cyst from edema are crucial in treatment planning for intramedullary disease and best delineated with MRI [97,98].

In cases in which MRI shows findings suspicious for arachnoid cyst/arachnoid web or ventral cord herniation, CT myelography can be performed for further evaluation [5,66,72]. Likewise, in cases in which there is clinical concern for positional myelopathy, MRI with flexion/extension can be performed as a follow-up [73].

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Metabolic causes of chronic or progressive myelopathy result in changes in the spinal cord known as subacute combined degeneration and are best evaluated with MRI [10,82,83]. Chronic infections can have a similar appearance [51].

Radiation-induced myelopathy is a rare, dose-dependent complication that anatomically localizes to a prior radiation port [84]. Autoimmune myelitis includes paraneoplastic myelopathy [85,86]. MRI without and with IV contrast is useful to evaluate the spinal cord in these instances.

In cases in which MRI shows findings suspicious for arachnoid cyst/arachnoid web or ventral cord herniation, CT myelography can be performed for further evaluation [5,66,72]. Likewise, in cases in which there is clinical concern for positional myelopathy, MRI with flexion/extension can be performed as a follow-up [73].

CT Myelography Spine Area of Interest. CT spine myelography may be useful in this setting to answer specific questions before surgical intervention. For example, it may be useful in the setting of metal implants (ie, spinal instrumentation, stimulator) if myelopathy is suspected and the region of interest is obscured due to MRI artifact [63,64]. In cases in which MRI shows findings suspicious for arachnoid cyst/arachnoid web or ventral cord herniation, CT myelography can be performed for further evaluation [5,66,74]. Likewise, in cases in which there is clinical concern for positional myelopathy, extension/flexion positional CT myelography can be performed as a follow-up [99]. In spondylotic myelopathy, conventional myelography can be used to diagnose severe canal stenosis [65,66]. However, MRI is best for evaluation of the marrow and the spinal canal/spinal cord [14-16].

CT Spine Area of Interest With IV Contrast. CT spine can depict osseous encroachment on the spinal canal from discs, osteophytes, and subluxation with better resolution than radiography. For inflammatory or infectious processes, CT can be beneficial to evaluate the osseous structures, and with the addition of IV contrast, CT can be helpful in demonstrating adjacent soft tissue involvement [67,68]; however, there is no relevant literature regarding improvement of myelopathy diagnosis with IV contrast. Although CT demonstrates osseous integrity with excellent assessment of bone destruction, MRI provides better visualization of the marrow and the spinal cord [14-16]. It is, therefore, not useful in the initial evaluation of noncompressive etiologies of chronic or progressive myelopathy.

CT Spine Area of Interest Without IV Contrast. CT spine can depict osseous encroachment on the spinal canal from discs, osteophytes, and subluxation with better resolution than radiography. For inflammatory or infectious processes, CT can be beneficial to evaluate the osseous structures [67,68]. Although CT demonstrates osseous integrity with excellent assessment of bone destruction, MRI provides better visualization of the marrow and the

spinal cord [14-16]. It is, therefore, not useful in the initial evaluation of noncompressive etiologies of chronic or progressive myelopathy.

Arteriography Spine Area of Interest. There is no relevant literature supporting the use of conventional arteriography spine in the initial imaging evaluation of chronic or progressive myelopathy. See Variant 3.

Radiography Spine Area of Interest. There is no relevant literature supporting the use of spine radiography as the initial imaging evaluation of chronic or progressive myelopathy. Although radiographs may demonstrate bone destruction, CT provides better visualization of the osseous spine [14-16]. In spondylotic myelopathy, radiographs may depict osteophytic narrowing of the spinal canal, whereas conventional myelography can be used to diagnose severe canal stenosis [65]. However, MRI is best for evaluation of the marrow and the spinal canal/spinal cord [14-16]. Lateral radiographs can be obtained as an adjunct to cross-sectional imaging to help assess alignment parameters and dynamic instability [71].

MRA Spine Area of Interest With IV Contrast. There is no relevant literature supporting the use of MRA spine in the initial imaging evaluation of chronic or progressive myelopathy. See Variant 3.

MRA Spine Area of Interest Without and With IV Contrast. There is no relevant literature supporting the use of MRA spine in the initial imaging evaluation of chronic or progressive myelopathy. See Variant 3.

MRA Spine Area of Interest Without IV Contrast. There is no relevant literature supporting the use of MRA spine in the initial imaging evaluation of chronic or progressive myelopathy. See Variant 3.

MRI Spine Area of Interest With IV Contrast. MRI spine with IV contrast is not typically performed independently as an initial study, as its interpretation is most informative when correlated with standard noncontrast sequences included in MRI spine without and with IV contrast.

CT Spine Area of Interest Without and With IV Contrast. CT spine can depict osseous encroachment on the spinal canal from discs, osteophytes, and subluxation with better resolution than radiography. For inflammatory or infectious processes, CT can be beneficial to evaluate the osseous structures, and with the addition of IV contrast, CT can be helpful in demonstrating adjacent soft tissue involvement [67,68]; however, there is no relevant literature regarding improvement of myelopathy diagnosis with IV contrast. Although CT demonstrates osseous integrity

with excellent assessment of bone destruction, MRI provides better visualization of the marrow and the spinal cord [14-16]. It is, therefore, not useful in the initial evaluation of noncompressive etiologies of chronic or progressive myelopathy.

CTA Spine Area of Interest With IV Contrast. There is no relevant literature supporting the use of CTA spine in the initial imaging evaluation of chronic or progressive myelopathy. See Variant 3.

Variant 3: Adult. Myelopathy with vascular etiology features on initial MRI. Next imaging study

The goal of imaging is to further localize a vascular lesion suspected to be causing myelopathy on initial imaging. Diagnostic imaging findings can potentially aid in early intervention of the vascular lesion, which can improve patient outcomes by reducing the duration of illness or severity of morbidity.

The body regions covered in this clinical scenario are cervical, thoracic, and lumbar spine. These body regions may be evaluated separately or in combination as guided by physical examination findings, patient history, and other available information, including prior imaging.

Arteriography Spine Area of Interest. Catheter-based digital subtraction angiography is considered the reference standard for detection and evaluation of spinal vascular malformations; however, it is recommended to be performed in concordance with time-resolved contrast-enhanced MRA, as incomplete vessel catheterization may lead to failure of lesion detection [100]. Two-dimensional digital subtraction angiography is the standard method, with recent development of 3-D imaging using rotation, and 4-D imaging using temporal resolution, further improving detection [101].

MRA Spine Area of Interest Without and With IV Contrast. If MRI demonstrates findings concerning for an underlying vascular malformations, MRA can be performed as a follow-up to demonstrate abnormal vasculature that may be useful to guide spinal arteriography and intervention [88-91]. Time-resolved MRA has been found to accurately diagnose spinal vascular malformations and decrease the amount of vessels needing to be catheterized on spinal angiography, which can both shorten procedure times and decrease potential complications [102,103]. When combined with heavily T2-weighted volumetric analysis, time-resolved MRA performed even better in diagnosis of multiple subtypes of spinal vascular malformations, including feeder vessel identification [104].

CTA Spine Area of Interest With IV Contrast. CTA continues to make progress as a preangiographic tool for localization of spinal vascular malformations [105-108]. In regard to noninvasive angiography, CTA is considered a second-line choice to MRA, but has demonstrated the potential to decrease the amount of vessels selected in catheter angiography [106,108-110].

MRA Spine Area of Interest With IV Contrast. If MRI demonstrates findings concerning for an underlying vascular malformations, MRA can be performed as a follow-up to demonstrate abnormal vasculature that may be useful to guide spinal arteriography and intervention [88-91]. Time-resolved MRA has been found to accurately diagnose spinal vascular malformations and decrease the amount of vessels needing to be catheterized on spinal angiography, which can both shorten procedure times and decrease potential complications [102,103]. When combined with heavily T2-weighted volumetric analysis, time-resolved MRA performed even better in diagnosis of multiple subtypes of spinal vascular malformations, including feeder vessel identification [104].

MRA Spine Area of Interest Without IV Contrast. Though noncontrast MRA using time-of-flight technique can be useful for demonstrating static vascular details, it offers limited temporal resolution, which hinders the evaluation of hemodynamic properties of vascular malformations. Because of this, time-resolved contrast-enhanced MRA is the preferred modality [111].

Radiography Spine Area of Interest. There is no relevant literature supporting the use of spine radiography to further evaluate myelopathy with vascular features on initial MRI.

MRI Spine Area of Interest With IV Contrast. There is no relevant literature supporting the use of MRI spine with IV contrast to further evaluate myelopathy with vascular features on initial MRI.

MRI Spine Area of Interest Without and With IV Contrast. There is no relevant literature supporting the use of MRI spine without and with IV contrast to further evaluate myelopathy with vascular features on initial MRI.

MRI Spine Area of Interest Without IV Contrast. There is no relevant literature supporting the use of MRI spine without IV contrast to further evaluate myelopathy with vascular features on initial MRI.

CT Myelography Spine Area of Interest. There is no relevant literature supporting the use of CT myelography spine to further evaluate myelopathy with vascular features on initial MRI.

CT Spine Area of Interest With IV Contrast. There is no relevant literature supporting the use of CT spine with IV contrast to further evaluate myelopathy with vascular features on initial MRI.

CT Spine Area of Interest Without and With IV Contrast. There is no relevant literature supporting the use of CT spine without and with IV contrast to further evaluate myelopathy with vascular features on initial MRI.

CT Spine Area of Interest Without IV Contrast. There is no relevant literature supporting the use of CT spine without IV contrast to further evaluate myelopathy with vascular features on initial MRI.

SUMMARY OF HIGHLIGHTS

This is a summary of the key recommendations from the variant tables. Refer to the complete narrative document for more information.

- **Variant 1:** In the setting of acute onset myelopathy, MRI of the cervical and/or thoracic spine is usually appropriate for initial imaging due to its superior contrast resolution for spinal cord/canal evaluation. It may be performed without and with IV contrast when there is possible inflammatory or neoplastic disease. It may be performed noncontrast when there is primary concern for degenerative stenosis.
- **Variant 2:** In the setting of chronic or progressive myelopathy, MRI of the cervical and/or thoracic spine is usually appropriate for initial imaging due to its superior contrast resolution for spinal cord/canal evaluation. It may be performed without and with IV contrast when there is possible inflammatory or neoplastic disease. It may be performed noncontrast when there is primary concern for degenerative stenosis.
- **Variant 3:** In the setting of myelopathy with vascular etiology features on initial MRI, spinal arteriography, dynamic time-resolved contrast-enhanced MRA, or CTA is appropriate complementary procedures for further evaluation. The decision regarding which of these three studies to perform first may depend on initial imaging features, institutional preferences, and multidisciplinary conferences/discussions.

SUPPORTING DOCUMENTS

The evidence table, literature search, and appendix for this topic are available at <https://acsearch.acr.org/list>. The appendix includes the strength of evidence assessment and the final rating round tabulations for each recommendation.

For additional information on the Appropriateness Criteria methodology and other supporting documents,

please go to the ACR website at <https://www.acr.org/Clinical-Resources/Clinical-Tools-and-Reference/Appropriateness-Criteria>.

GENDER EQUALITY AND INCLUSIVITY CLAUSE

The ACR acknowledges the limitations in applying inclusive language when citing research studies that predates the use of the current understanding of language inclusive of diversity in sex, intersex, gender, and gender-diverse people. The data variables regarding sex and gender used in the cited literature will not be changed. However, this guideline will use the terminology and definitions as proposed by the National Institutes of Health [112].

RELATIVE RADIATION LEVEL INFORMATION

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, because of both organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared with those specified for adults (see Table 2). Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® Radiation Dose Assessment Introduction document [113].

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